

# **Greater Changhua South East Offshore Wind Farm – Non-Technical EIA Summary**

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## List of acronyms

<b>BAP</b>	Biodiversity action plan
<b>BOD</b>	Biological oxygen demand
<b>BOE</b>	Bureau of Energy
<b>CHA</b>	Critical habitat assessment
<b>CIA</b>	Cumulative impact assessment
<b>COD</b>	Commercial operation date
<b>DO</b>	Dissolved oxygen
<b>E&amp;S</b>	Environmental and social
<b>EBRD</b>	European Bank for Reconstruction and Development
<b>EHS</b>	Environmental health and safety
<b>EIA</b>	Environmental impact assessment
<b>EP</b>	Equator Principles
<b>EPA</b>	Environmental Protection Administration
<b>ERP</b>	Emergency response plan
<b>ESMS</b>	Environmental and social management system
<b>GHG</b>	Greenhouse gas
<b>HVAC</b>	High voltage alternating current
<b>IFC</b>	International Finance Corporation
<b>LRP</b>	Livelihood restoration plan
<b>NOAA</b>	National Oceanic and Atmospheric Administration
<b>NO<sub>2</sub></b>	Nitrogen dioxide
<b>NTS</b>	Non-technical summary
<b>O<sub>3</sub></b>	Ozone
<b>PEL</b>	Probable effect level
<b>PM<sub>2.5</sub></b>	Particulate matter with a diameter of less than 2.5 micrometres
<b>PM<sub>10</sub></b>	Particulate matter with a diameter of less than 10 micrometres
<b>PS</b>	Performance Standards
<b>SE</b>	Southeast
<b>SEP</b>	Stakeholder engagement plan
<b>SO<sub>2</sub></b>	Sulfur dioxide
<b>SS</b>	Suspended solids
<b>TPC</b>	Taiwan Power Company
<b>TSP</b>	Total suspended particles
<b>TTS</b>	Temporary threshold shift

**WBG**

World Bank Group

**WTGs**

Wind turbine generators

# 1 Introduction

## 1.1 Overview

This non-technical summary (NTS) of the environmental impact assessment (EIA)<sup>1</sup> presents the main findings and conclusions of the environmental and social (E&S) studies that have been undertaken for the proposed 605.2MW Greater Changhua Southeast (SE) offshore wind farm located in Taiwan, off the coast of Changhua County (the Project). This NTS briefly describes the Project, presents main findings from surveys undertaken to assess the potential impacts and outlines mitigation measures.

## 1.2 The Project's EIA

The Project is being developed by Greater Changhua Offshore Wind Farm SE Ltd. (the Project Company) through Ørsted Wind Power A/S (the Sponsor). Further details of the Project are included in section 2.

A part of the Project's development and permitting requirements, the preparation and submission of an EIA was undertaken. The Project has successfully obtained regulatory approval from the Taiwan Environmental Protection Administration (EPA) for its EIA report on 23 March 2018, with the approved EIA report formally acknowledged/archived in July 2018. Subsequently, the Project submitted an application to amend the environmental monitoring plans which was approved by the EPA on 18 March 2019.

The present document is the Project's NTS which summarises the findings of the 2018 EIA including the outcomes of the 2019 EIA amendment report. The EIA report includes the following content:

- Chapter 1: Project Company information
- Chapter 2: Project Company personnel information
- Chapter 3: EIA authors
- Chapter 4: Project location and environmental sensitive areas
- Chapter 5: Project rationale and development plans
- Chapter 6: Project baseline
- Chapter 7: Project impact assessment
- Chapter 8: Environmental protection measures
- Chapter 9: Estimate costs for implementing environmental management plan
- Chapter 10: Summary of Project impacts and mitigation measures
- Chapter 11: EIA conclusion

The EIA amendment report was to provide an updated indicative date for implementing the pre-construction monitoring plan.

Both the EIA report and EIA amendment report are available online on the EPA website at:

<https://eiadoc.epa.gov.tw/EIAWEB/10.aspx?hcode=1060461A&srctype=0>

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<sup>1</sup> The final full Project EIA report was submitted to the Taiwan Environmental Protection Administration (EPA) on 23 March 2018, with the approved EIA report formally acknowledged/archived in July 2018.

### 1.3 Project E&S compliance requirements

In addition to complying with the requirements of the laws and regulations of Taiwan, the Project was also required to comply with the international standards and guidelines as required by the Project's Lenders, including following:

- Equator Principles (EP) 4 (July 2020)
- International Finance Corporation (IFC) Performance Standards (PS) (2012)
- World Bank Group (WBG) Environmental Health and Safety (EHS) General Guidelines (2007) and sector-specific EHS guidelines, which include:
  - WBG EHS Wind Energy Guidelines (2015)
  - WBG EHS Guidelines for Electric Power Transmission and Distribution Guidelines (2007)

## 2 Project description

### 2.1 Overview

The 605.2MW Greater Changhua Southeast (SE) offshore wind farm (the Project) is being developed by Greater Changhua Offshore Wind Farm SE Ltd. (the Project Company). The Project is located in Taiwan, off the coast of Changhua County. The offshore wind farm area selected was zone #15 of the list of proposed offshore wind farm sites in Taiwan demarcated by the Bureau of Energy (BOE). An overview of the Project is presented in Table 2.1.

**Table 2.1: Summary of Project information**

Aspect	Detail <sup>[A]</sup>
<b>Project development</b>	
Project name	Greater Changhua Southeast (SE) offshore wind farm
Project Company	Greater Changhua Offshore Wind Farm SE Ltd.
Project Sponsor	Ørsted Wind Power A/S
Windfarm capacity	605.2MW
<b>Location</b>	
Windfarm location	Taiwan, off the coast of Changhua County
Windfarm area	108.7km <sup>2</sup>
Distance to shore	35.7km (nearest WTG distance to shore)
Water depth	34.4-44.1m
<b>Project components</b>	
Number of wind turbine generators (WTGs) and capacity	75 WTGs (8.069MW)
Substations	Offshore: One 600MW high voltage alternating current (HVAC) Onshore: One 600MW (HVAC)
Transmission	66kV/ 220kV/ 161kV HVAC
Export cables	Offshore: Two 230kV export cables (from offshore station to landing points) with length of about 55km each Onshore: 161kV export cables (from onshore substation to grid connection point) with length of about 4.35km each
Grid point of connection	Chang One A substation (in Changhua County) operated by Taiwan Power Company (TPC)
<b>Project schedules</b>	
Construction commencement	Onshore construction to commence in 2019 Q3 Offshore installation to commence in 2021 Q1
Commercial operation date (COD)	Q4 2022

Note: [A] Where information in the EIA (2018) has been superseded by the Project establishment permit (finalised amendment) (大彰化東南離岸風力發電計劃籌設計劃書變更案定稿本) (February 2020), information from the Project establishment permit is presented instead.

### 2.2 Project rationale and alternative analysis

In response to the Taiwan government's renewable energy policies to ultimately achieve nuclear-free status by 2025, the development of the Project was proposed by the Project Company with the added intention to promote offshore wind farm development in Taiwan. The Project area was chosen

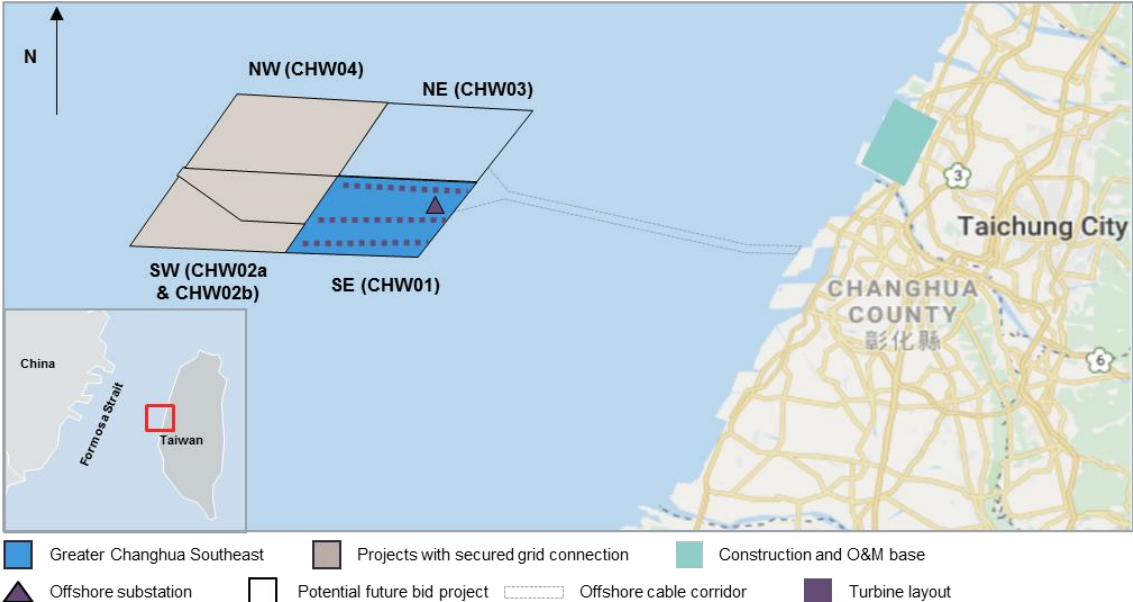


from a list of proposed offshore wind farm sites in Taiwan as demarcated by the BOE<sup>2</sup>. With the implementation of the Project, it is seen to contribute to the local government’s roadmap for increasing renewable energy output within the country. Alternative construction methods were considered with mitigation measures identified which aligned with the measures in the approved environmental management plan (Chapter 8 of the EIA). Details are provided in the subsequent sections of this NTS.

### 2.3 Project location

The Project offshore wind farm is located in Taiwan, at least 35.7km off the coast of Changhua County (Figure 2.1). The offshore components of the Project include an array of 75 WTGs and an offshore substation (Figure 2.2 and Figure 2.3), whilst the onshore components are located within the Changhua Coastal Industrial Park in Lunwei Zone (Figure 2.4). A summary of the Project components is presented in Figure 2.5.

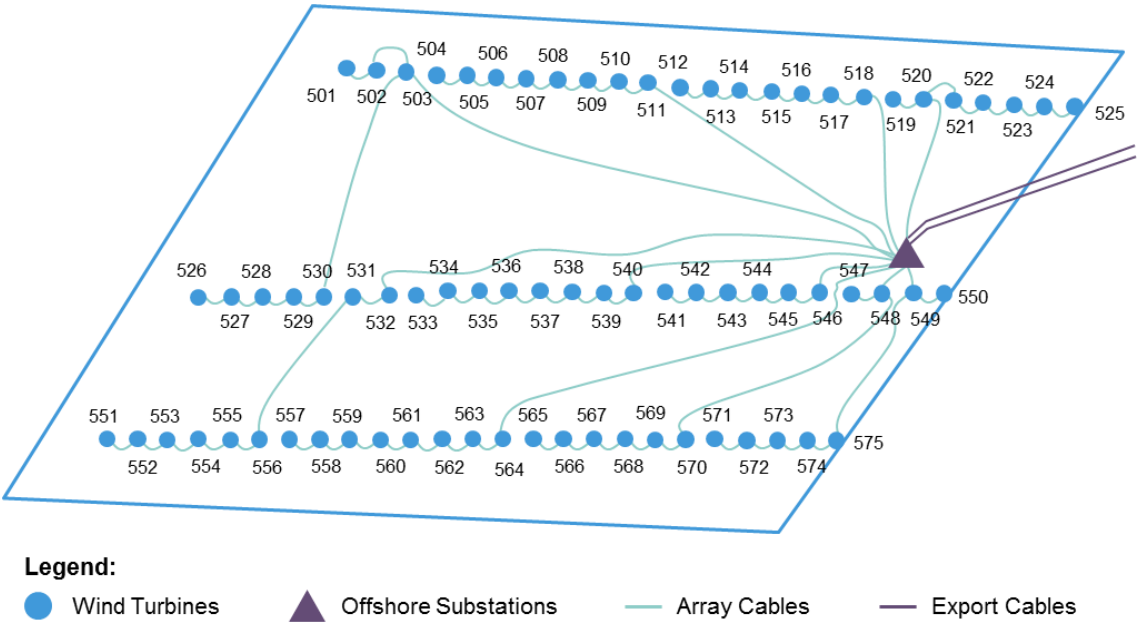
Figure 2.1: Overview of all Project components



Source: Project Company

<sup>2</sup> The map of proposed offshore wind farm sites in Taiwan is indicated in Appendix 2 of the in the Bureau of Energy’s “Notes on Application for Offshore Wind Farm Potential Sites” (離岸風力發電規劃場址申請作業要點) dated 2 July 2015, retrieved from: [https://www.moeaboe.gov.tw/ECW/populace/Law/Content.aspx?menu\\_id=2870](https://www.moeaboe.gov.tw/ECW/populace/Law/Content.aspx?menu_id=2870)

Figure 2.2: CHW01 offshore wind farm site layout



Source: Project Company

Figure 2.3: CGI rendering of the CHW01 offshore substation



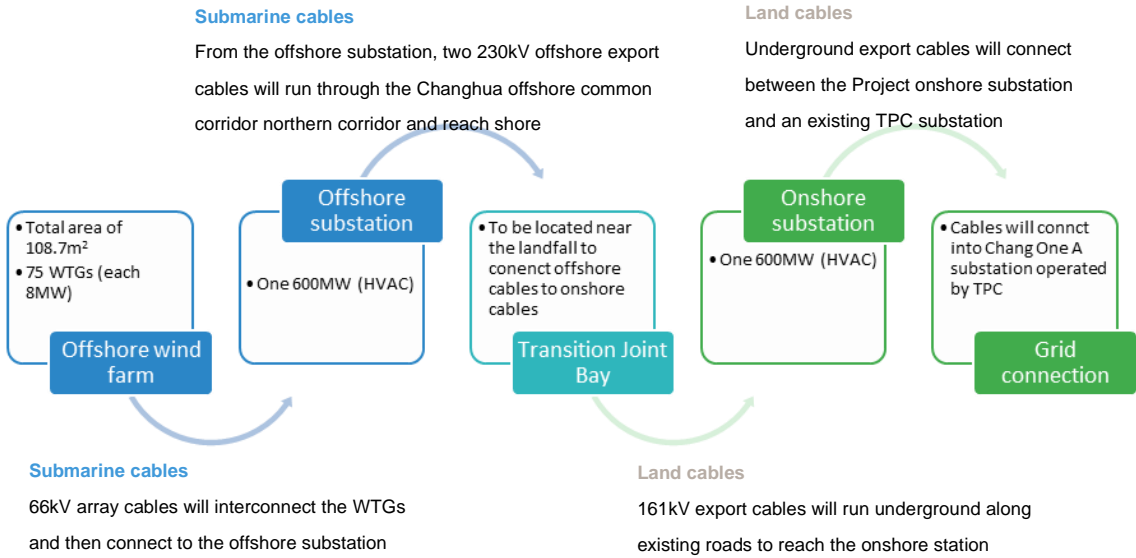
Source: Project Company

Figure 2.4: CGI rendering of the CHW01 onshore substation



Source: Project Company

Figure 2.5: Summary of Project components



The Project Company intends to use Taichung Port as the base port for onshore construction activities (ie inspection and pre-assembly works) and logistical support. It will also be the base for the operation and maintenance phase in line with the EIA.

2.4 Implementation schedule

The key milestones for Project implementation, as per current assumptions are summarised as follows:

Project milestone	2019				2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Onshore construction																
Offshore construction – FOU, OSS & Cables																
Offshore Construction - WTG																
Commercial operation date (COD)																

## 3 Baseline conditions

### 3.1 Overview

As part of the EIA, primary and secondary baseline data were collected for key environmental and social (E&S) parameters to inform the impact assessment process. Key E&S baseline conditions are presented in the following subsections. Further details can be found in Appendix A and in the EIA available online. Understanding the baseline conditions would help assess the extent of potential Project impacts.

### 3.2 Environmental baseline

Environmental components that are most relevant to the Project within the context of potential environmental impacts include air quality, noise (including air-borne noise and underwater noise), vibration, surface water quality, groundwater quality, soil/sediment quality, electromagnetic field and biodiversity. A number of environmental surveys were conducted between 2016 and 2017 as part of the EIA process to establish the baseline conditions. Monitoring data from existing EPA monitoring stations were also obtained to assess baseline conditions.

Environmental baseline conditions of the Project area and its surroundings were generally compliant when compared with the national standards as summarised in Table 3.1 below.

**Table 3.1: Environmental baseline conditions**

Aspect	Environmental baseline conditions
Air quality	Compliant for Class II (for PM <sub>10</sub> , O <sub>3</sub> , SO <sub>2</sub> , NO <sub>2</sub> and CO) and Class III (for PM <sub>2.5</sub> ) air pollution control zone. Exceedances in TSP and PM <sub>2.5</sub> were observed in some receptors (eg Lugang Industrial Zone, Putian temple, Tianbao temple and Fushun temple) on some days.
Noise and Vibration	<p><b>Airborne noise</b></p> <p>Results showed that baseline noise levels were generally compliant with nationally prescribed standards. Exceedances in night time levels noise were observed at Show Chwan Memorial hospital. Low-frequency noise levels also exceeded nationally prescribed standards at Wuqi Elementary School and Changhua Coastal Industrial Park.</p> <p><b>Underwater noise</b></p> <p>The underwater noise profile of the offshore windfarm and cable area was characterised through 1Hz spectrograms and 1/3 octave band frequency levels. Unidentified biological noises were also recorded, suggesting that fish or other marine animals inhabit the waters.</p>
Surface water quality	<p><b>Offshore windfarm and cable area</b></p> <p>Compliant with nationally prescribed water quality standards for Class B marine water body.</p>

In terms of biodiversity, baseline surveys identified several species including some protected species which are presented in Table 3.2.

Table 3.2: Species recorded during the baseline surveys

Aspect	Species recorded
Terrestrial plants	Up to 142 species were recorded in a single survey. Overall, four species are endemic and three are rare (but considered to be artificially introduced). The three rare <sup>3</sup> plant species are: <ul style="list-style-type: none"> <li>• Lanyu podocarp or Arius (蘭嶼羅漢松) (<i>Podocarpus costalis</i>)</li> <li>• Fukugi tree (福木) (<i>Garcinia subelliptica</i>)</li> <li>• Portia tree or Rosewood (繖楊) (<i>Thespesia populnea</i>)</li> </ul>
Terrestrial mammals	Up to 13 species, of which four were endemic, were recorded in a single survey. None were nationally protected.
Terrestrial birds	Up to 48 species, of which seven were endemic, were recorded in a single survey. Four nationally protected species were identified, namely: <ul style="list-style-type: none"> <li>• Common kestrel (紅隼) (<i>Falco tinnunculus</i>): Taiwan Category II protected species</li> <li>• Black-winged kite (黑翅鸞) (<i>Elanus caeruleus</i>): Taiwan Category II protected species</li> <li>• Oriental pratincole (燕鴿) (<i>Glareola maldivarum</i>): Taiwan Category III protected species</li> <li>• Brown shrike (紅尾伯勞) (<i>Lanius cristatus</i>): Taiwan Category III protected species</li> </ul>
Terrestrial amphibians and reptiles	Up to six species, of which one was endemic, were recorded in a single survey. None were nationally protected.
Marine birds	A total of 212 counts from 13 species were identified. Three species were found to be nationally protected, namely: <ul style="list-style-type: none"> <li>• Bridled tern (褐翅燕鷗) (<i>Onychoprion anaethetus</i>): Taiwan Category II protected species</li> <li>• Roseate tern (粉紅燕鷗) (<i>Sterna dougallii</i>): Taiwan Category II protected species</li> <li>• Greater crested tern (大風頭燕鷗) (<i>Thalasseus bergii</i>): Taiwan Category II protected species</li> </ul> Radar surveys found that two raptor species flew passed the windfarm area, including: <ul style="list-style-type: none"> <li>• Grey-faced buzzard (灰面鵟鷹) (<i>Butastur indicus</i>): Taiwan Category II protected species</li> <li>• Chinese sparrowhawk (赤腹鷹) (<i>Accipiter soloensis</i>): Taiwan Category II protected species</li> </ul>
Coastal birds	24,359 counts from 40 species were identified. A total of seven nationally protected species were identified namely: <ul style="list-style-type: none"> <li>• Black-faced spoonbill (黑臉琵鷺) (<i>Platalea minor</i>): Taiwan Category I protected species</li> <li>• Black-winged kite (黑翅鸞) (<i>Elanus caeruleus</i>): Taiwan Category II protected species</li> <li>• Osprey (魚鷹) (<i>Pandion haliaetus</i>): Taiwan Category II protected species</li> <li>• Common kestrel (紅隼) (<i>Falco tinnunculus</i>): Taiwan Category II protected species</li> <li>• Little tern (小燕鷗) (<i>Sternula albifrons</i>): Taiwan Category II protected species</li> <li>• Eurasian curlew (白腰杓鷗/大杓鷗) (<i>Numenius arquata</i>): Taiwan Category III protected species</li> <li>• Oriental pratincole (燕鴿) (<i>Glareola maldivarum</i>): Taiwan Category III protected species</li> </ul>
Cetaceans	Indo-pacific bottlenose dolphins (印太瓶鼻海豚) ( <i>Tursiops aduncus</i> ), a Taiwan Category II protected species, were observed twice during the surveys.

Overall, eleven nationally protected bird species were identified. For cetaceans, sightings of Indo-pacific bottlenose dolphins were observed. It was noted that while the Project offshore cable alignment cuts across the proposed Major Wildlife Habitat of the Taiwanese humpback dolphins (*Sousa chinensis* ssp. *taiwanensis*)<sup>4</sup>, no Taiwanese humpback dolphins were observed during the surveys.

<sup>3</sup> The rare status of the plant species were not based on the Taiwan EPA plant ecology EIA assessment guidelines (植物生態評估技術規範), but were listed in the Preliminary Red List of Taiwanese Vascular Plants (臺灣維管束植物紅皮書初評名錄之物種).

<sup>4</sup> The Taiwanese humpback dolphins (*Sousa chinensis* ssp. *taiwanensis*) is a Taiwan Category I protected species. The proposed Taiwanese humpback dolphins Major Wildlife Habitat was announced on 21 April 2014 under the Wildlife Conservation Act (Article 8). The official letter (letter no.

Additional bird surveys were conducted between winter of 2017 and spring of 2018, as part of a larger Greater Changhua bird survey involving other wind farms around the Project<sup>5</sup>. Survey results recorded a total of 37 counts from six identified bird species, all of which were also recorded during the EIA except for the White-winged black tern (白翅黑燕鷗) which is not nationally protected.

### 3.3 Social baseline

A key stakeholder group identified through the social baseline was the Changhua Fishery Association, whose designated fishing zone overlaps with the Project offshore export cable route (Figure 3.1). Economic displacement is expected as non-Project vessels will be prohibited from entering the fishing ground during construction. Details of the social baseline surveys conducted are available in the EIA published online. Key social baseline conditions for the Project are presented in Table 3.3.

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1031700504, dated 21 April 2014) with the delineation of the proposed Major Wildlife Habitat area can be retrieved from:  
<https://conservation.forest.gov.tw/latest/0045579>

<sup>5</sup> Changhua and Yunlin Offshore Wind Farm Project Environmental Impact Survey Report (彰化雲林地區離岸式風力發電計畫環境影響調查報告), dated July 2019.





Aspect	Baseline conditions
Economic displacement	<ul style="list-style-type: none"> <li>● Pole and line fishery, with main catch such as sweetlip and croaker</li> <li>● Shallow sea aquaculture, with main catch such as oyster, clam and other bivalves</li> <li>● Other fishery methods catching a variety of coastal fish</li> </ul> <p>The Project offshore export cable route overlaps with the designated fishing zone of the Changhua Fishery Association. Economic displacement is expected as non-Project vessels will be prohibited from entering the fishing ground during construction.</p>
Indigenous people	No indigenous peoples are identified in the Project area.
Land-based cultural resources	<p>Literature review indicated that 27 tangible forms of cultural heritage and 23 archaeological sites were located in the larger Changhua County.</p> <p>No tangible and intangible forms of cultural resources were identified within 2km of the Project area.</p>
Underwater cultural resources	<p>Literature review indicated that 13 shipwrecks are located near the windfarm, and one is located within the Project windfarm.</p> <p>No underwater cultural resources were identified by the sonar surveys.</p>
Visual impact and tourism	<p>The Project is located at least 35.7km off the coast of Changhua County. The coastal area around the Project components comprises mainly of industrial zones, fish farms, river swamps, farming areas and residential areas.</p> <p>In terms of tourism/recreation features that may attract local visitors, natural landscape elements include coastal wetlands and sandbars, while man-made landscape features include fish farms and various cultural/historical sites (as mentioned above under land-based cultural resources).</p>

Several engagement activities (ie information disclosure, consultation and participation) have been undertaken with stakeholders as part of the EIA process, which is summarised in section 7.

## 4 Key potential E&S impacts

### 4.1 Overview

Typical construction-related and operation-related impacts from the Project activities are presented, along with the studies conducted as part of the EIA to assess the impacts on key E&S components. Mitigation and monitoring measures have also been proposed as part of the EIA to manage the potential E&S impacts.

### 4.2 Expected Project impacts

Potential E&S impacts may arise throughout the Project lifecycle, particularly during the construction phase. Typical construction phase activities that may impact the environment include land clearing for site preparation and access routes, excavation, construction activities, laying of land cables, and transportation of materials for onshore activities. Offshore activities with environmental impacts may include piling, laying of submarine cables, installation of WTG foundations and WTG erection.

Various methodologies were carried out during the impact assessment to determine the potential Project impacts throughout development. The methodologies and corresponding results are detailed in the EIA available online, and are summarised in the table below for each E&S aspect relevant to the Project.

**Table 4.1: Summary of Project impacts**

Aspect	Expected Project impact	Impact assessment findings
<b>Construction phase</b>		
Air quality	Sources of air pollutants during construction include: <ul style="list-style-type: none"> <li>Dust from exposed construction sites</li> <li>Emissions from construction machinery, vehicles and vessels</li> </ul>	Exceedances in TSP, PM <sub>2.5</sub> and PM <sub>10</sub> are predicted at locations within the Changhua Coastal Industrial Park, but baseline levels at these locations had already exceeded local standards. Mitigation measures will be implemented in accordance with national regulations (detailed in Table 5.2) to ensure that impacts from the construction sites are limited and short-term. Impact from construction vehicles are assessed to be limited and short-term.
Greenhouse gas (GHG) emissions	Sources of GHG during construction include: <ul style="list-style-type: none"> <li>Machinery fuel</li> <li>Electricity consumption</li> </ul>	Total GHG emissions (from both onshore and offshore construction activities) was calculated to be 19,527 metric tons.
Airborne noise	Source of airborne noise during construction include: <ul style="list-style-type: none"> <li>Construction activities at construction sites</li> <li>Movement of construction vehicles</li> </ul>	Noise levels at the nearest receptors (ie Show Chwan Memorial hospital and Changhua Coastal Industrial Park Service Centre) are found to be complaint with nationally prescribed standards for the daytime.
Vibration	Vibration impacts may be expected from construction machinery and vehicles.	Vibration impact is assessed to have no impact to human sensations.
Underwater noise	Sources of underwater noise during construction include: <ul style="list-style-type: none"> <li>WTG foundation piling activities (ie key source)</li> <li>Construction vessels</li> </ul>	Sound pressure level at a distance of 750m from the point source is predicted to range from 155-170dB at the four monitoring locations modelled. (Refer to section 5 for mitigation measures.)
Surface water quality	Sources of wastewater that may affect surface water during construction include: <ul style="list-style-type: none"> <li>Runoff from onshore substation site;</li> <li>Domestic wastewater from construction workers.</li> </ul>	Wastewater generation rates are calculated and considered to be manageable. (Refer to section 5 for mitigation measures.)
Groundwater quality	Maximum excavation depth at the onshore substation is 1-3m, which would not cause groundwater upwelling.	Temporary impact due to infiltration of direct runoff may be expected, but overall no significant impact is expected.
Seawater quality	Offshore activities that may affect seawater include: <ul style="list-style-type: none"> <li>Foundation associated works for WTG</li> <li>Laying of subsea cables</li> </ul>	Increment in suspended solid (SS) levels are expected but assessed to be localised and temporary with limited impact due to local diurnal tidal patterns.
Solid waste	Solid waste would be generated from the construction workers.	Up to 179.96kg of solid waste may be generated daily, but this is not expected to burden local waste handling capacity.
Biodiversity – Terrestrial plants	Terrestrial plants may be affected through: <ul style="list-style-type: none"> <li>Vegetation clearance during construction</li> </ul>	The existing onshore areas to be utilised by the Project are mainly artificial forest (ie windbreaks) and wasteland.

Aspect	Expected Project impact	Impact assessment findings
	<ul style="list-style-type: none"> <li>Pollution (eg dust, wastewater and waste)</li> </ul>	The three rare plants species found during the surveys were considered to be artificially introduced and were not considered to be naturalised or abundant. Mitigation measures are in place (as described in Table 5.2) to prevent extensive vegetation removal and adverse impacts to plant growth (ie dust, introduction of alien species).
Biodiversity – Terrestrial animals	Terrestrial animals may be affected by: <ul style="list-style-type: none"> <li>Loss of habitats (due to vegetation clearance)</li> <li>Roadkill by construction vehicles</li> </ul>	The existing Project area is an industrial zone. It is expected that animals that occupy the area would be adaptable to anthropogenic presence. With regards to the protected bird species, the Project area is relatively small compared to their typical range in Taiwan and would not be considered an important habitat for the bird species.
Biodiversity – Fish	The most significant impact to fish during construction would be the loss of habitat. Other impacts include underwater noise and increased SS levels.	Loss of habitats during construction is temporary. Underwater noise and increased SS levels are not expected to be significant as only individuals within a close range would be affected and impacts are expected to be localised and temporary.
Biodiversity – Seabirds	Construction activities may result in habitat loss (ie breeding sites and food foraging area) for seabirds.	It is speculated that the three protected tern species identified may be part of the breeding population from Penghu islands, which is about 60km from the Project site. Since the number of individuals recorded was not high, impact of habitat loss to the terns is assessed to be limited. However, continual monitoring is recommended.
Biodiversity – Cetaceans	The main impact to cetaceans would be underwater noise (mainly from impulsive piling) and vessel traffic. The use of vessels may also present a risk of collision with cetaceans.	Sound pressure level at a distance of 750m from the point source is predicted to range from 155-170dB at the four monitoring locations modelled. It was recommended that mitigation measures be proposed during construction to minimise impacts to cetaceans.
Fishery impacts	Fishing activities would be affected as non-Project vessels are prohibited from entering the fishing ground during construction.	The Project Company has been communicating with the Changhua Fishery Association regarding compensations matters. (Refer to section 7 for more details.) Compensation will be calculated according to Taiwan’s offshore wind farm fishery compensation guidelines.
Public infrastructure	The influx of Project labour may impact public facilities (eg roads and healthcare facilities).	Service standards at road sections and intersections are assessed to be generally unaffected. The Project intends to use community hospitals or clinics only in the event of emergencies or accidents.
Visual impact and tourism	Coastal recreational and scenic area may be affected by the presence of construction activities.	Since the majority of the construction work will take place at relatively far distance (ie at least 35.7km from the shore), extent of change in the existing landscape is determined to be quite small. Traffic impact to visitors accessing local recreation/tourism sites are assessed to be insignificant as traffic conditions can be maintained at service levels of A-C.
Cultural impact	Construction activities (both onshore and offshore) may uncover cultural resources.	The possibility of encountering archaeological sites within the onshore construction sites is relatively low, considering the artificial backfill condition of the existing land. Literature review indicated that one shipwreck was located within the Project windfarm. Sonar surveys did not identify any underwater cultural resources. Mitigation measures have been proposed in the event underwater cultural resource is found during the construction works.
Labour and working conditions	Project Company should ensure that labour and working conditions comply with applicable laws and standards.	The Project Company has established a code of conduct with business partners that outlines requirements to comply with applicable laws, respect for labour and human rights and anti-corruption. The code of conduct is included in the contracts with contractors to ensure compliance with the applicable law and standards. A human resources policy and associated procedures incorporating the requirements of IFC PS2 and Taiwanese Labour Laws have also been developed.

Aspect	Expected Project impact	Impact assessment findings
<p>With regards to migrant workers (if engaged by the Project), the Project would be expected to adhere to the Dakar Principles. Any accommodation provided by the Project Company or its contractors will have to follow the joint IFC/EBRD Guidance on workers accommodation<sup>6</sup>.</p>		
<b>Operation phase</b>		
Airborne noise	The key source of airborne noise during the operation stage is expected to be from the WTG rotating blades.	Both full frequency and low frequency noise levels at the receptors are determined to be compliant with nationally prescribed standards.
GHG emissions	Sources of GHG during operation include: <ul style="list-style-type: none"> <li>• Electricity consumption</li> <li>• Fuel consumption for maintenance vessels</li> </ul>	Total GHG emissions from operational activities was calculated to be 7,165 metric tons. Total GHG reductions from the operation of the wind farm was calculated to be 1,269,600 metric tons.
Underwater noise	Underwater noise may be generated from vibrations of the WTG that are transmitted through the water body.	Assuming a noise source level of 144dB, a 40dB reduction in the noise level could be achieved within 100-400m from the source and no significant impact is expected.
Surface water quality	Sources of wastewater that may affect surface water during operation include: <ul style="list-style-type: none"> <li>• Runoff from onshore substation</li> <li>• Domestic wastewater from onshore substation</li> </ul>	Wastewater generation rates are calculated and considered to be manageable. (Refer to section 5 for mitigation measures.)
Groundwater quality	Groundwater extraction will not be required as water will be supplied by the Taiwan Water Supply Company.	No significant impact is expected.
Electromagnetic field	The onshore substation and land cables may have an impact on electromagnetic fields when in operation.	The calculated electromagnetic field values at the receptors are all compliant with EPA standard.
Solid waste	Solid waste would be generated from the onshore substation when in operation. Where vessels are required during operation, solid waste may also be generated on board.	An estimated 81.8kg of solid waste may be generated daily assuming up to 100 workers would be hired during peak construction period. This is not expected to burden local waste handling capacity. 180L of marine waste may be generated offshore daily on a crew transport vessel. Crew transport vessels will be equipped with the capacity to contain waste generated by workers on board.
Biodiversity – Fish	The presence of the WTGs (and offshore substation) would present a change in the marine habitat. Noise and electromagnetic impacts may also be anticipated.	Operational underwater noise and electromagnetic waves may affect larger marine organisms in closer range, but there has been no concrete studies or evidence to support this claim. It is also expected that the foundation structure and protection may serve as artificial reef and provide a new habitat for many species.
Biodiversity – Seabirds	During the operation of the wind farm, there is concern that seabirds may collide with the rotating blades of the WTGs.	Simulation results indicate an overall avoidance rate of 0.98, with total collision counts for all species estimated at 47 individuals assuming WTG capacity of 8MW. Breeding seabirds would be the most vulnerable due to specificity in their habitat, although it is noted that their flight altitude falls within 5-10m. The sweeping range of the WTG is estimated at 55-265m.

<sup>6</sup> Workers' Accommodation: Processes and Standards. A guidance note by IFC and the EBRD. (2009) Retrieved from: [https://www.ifc.org/wps/wcm/connect/topics\\_ext\\_content/ifc\\_external\\_corporate\\_site/sustainability-at-ifc/publications/publications\\_gpn\\_workersaccommodation](https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_gpn_workersaccommodation)

Aspect	Expected Project impact	Impact assessment findings
Biodiversity – Cetaceans	The main impact to cetaceans would be underwater noise (from vibrations of the operation WTGs) and vessel traffic (for maintenance activities).	Monitoring during the operational period will also take place (see Table 5.1). Assuming a noise source level of 144dB, a 40dB reduction in the noise level could be achieved within 100-400m from the noise source, which would not lead to temporary threshold shift (TTS) impacts (ie temporary physiological injury to hearing organs) to cetaceans.
Fishery impacts	The presence of the WTGs may affect fishing activities depending on the fishing method.	The wind farm is located 20-30 nautical miles from the shore whilst local fishing activity is mostly confined within 12 nautical miles from the shore. Therefore, the wind farm is not expected to obstruct local fishing activities.
Public infrastructure	The presence of Project labour may impact public facilities (eg roads and healthcare facilities).	Service standards at road sections and intersections are assessed to be generally unaffected. The WTGs will be operated under a wholly automated surveillance system and there would not be a need for on-site operators except for maintenance personnel during maintenance. Provision of services by local public facilities are not expected to be impacted.
Visual impact	Coastal recreational and scenic area may be affected by the presence of the WTGs.	Since the WTGs are located in the sea at a relatively far distance (ie at least 35.7km from the shore), extent of change in the existing landscape is determined to be quite small.

## 5 Environmental management plan

### 5.1 Mitigation measures

Although the impact assessment has determined negligible or low predicted impacts for most aspects, the Project Company has still proposed the implementation of various mitigation measures for different phases of the Project (ie pre-construction, construction and operation). Table 5.1, Table 5.2 and Table 5.3 below summarise the pre-construction, construction and operation phase measures, respectively.

**Table 5.1: Summary of pre-construction phase mitigation measures**

Aspect	Mitigation measure
Biodiversity – Seabirds	<p><b>Project design</b></p> <ul style="list-style-type: none"> <li>An interval of 500m will be maintained between each WTG.</li> </ul> <p><b>Coordination with surrounding wind farms</b></p> <ul style="list-style-type: none"> <li>The four Greater Changhua wind farms (including the Project) will retain eight flight corridors within the wind farms, each at least 2km in width.</li> <li>Between each wind farm, a buffer zone of six times the rotor diameter will be maintained.</li> </ul>
Biodiversity – Marine ecology	<p><b>Project design</b></p> <ul style="list-style-type: none"> <li>The subsea cables will take the shortest route feasible to shore.</li> <li>The Project will adhere to the BOE-approved “Changhua Offshore Wind Power Marine Cable Common Corridor” adjustments promulgated on 2 August 2017.</li> </ul>
Fishery impacts	<p><b>Coordination with stakeholders</b></p> <ul style="list-style-type: none"> <li>Discussion with the Changhua Fishery Association regarding compensation matters will be initiated upon obtaining the Establishment Permit.</li> <li>Relevant information (eg construction schedule, area and vessels used) will be provided to the local port authority for dissemination to local communities.</li> </ul>
Cultural impact	<p><b>Project design/Survey</b></p> <ul style="list-style-type: none"> <li>Geological drilling will be conducted at each planned WTG location and the boreholes obtained will be assessed by certified archaeologists to determine the presence of culturally significant underwater cultural heritage material.</li> <li>Geological drilling will be conducted at least three points within the onshore substation site.</li> </ul>
Surface water	<p><b>Project design</b></p> <ul style="list-style-type: none"> <li>The Project Company will submit a runoff wastewater pollution reduction plan to the relevant local authority for approval before commencing construction.</li> </ul>

**Table 5.2: Summary of construction phase mitigation measures**

Aspect	Mitigation measure
Air quality	<p><b>For construction sites</b></p> <ul style="list-style-type: none"> <li>The Project will follow the Control Method of Air Quality Deterioration. Should the local authority issue an air quality deterioration warning, the Project will conduct air pollution prevention measures and enhance water spraying. Should a secondary degree warning be issued, all construction work will stop immediately to prevent worsening of air quality.</li> <li>The Project will follow the Construction Air Pollution Prevention Equipment Management for pollution prevention during construction.</li> <li>The Project will follow the Air Pollution Control Fee Collection Regulations to pay pertinent fees prior to starting construction work.</li> <li>Full barrier fence with minimum height of 2.4m will be erected around the substation construction area except at street corners or 10m within street corners wherein half barrier fence will be built.</li> </ul>

Aspect	Mitigation measure
	<ul style="list-style-type: none"> <li>Dust suppression measures should be implemented at the substation construction site and along construction roads (eg watering bare surfaces, clearing accumulated dust and laying steel platforms/ concrete/ asphalt/ coarse grading on roads).</li> <li>Signs will be installed at the construction site which states the Project air pollution control fee collection control serial number, the name and contact number of the person responsible for the construction site as well as the local environmental agency's contact number for reporting public nuisances.</li> </ul> <p><b>For construction vehicles/machinery</b></p> <ul style="list-style-type: none"> <li>Soil-carrying vehicles must be covered (eg using anti-dust mesh) to avoid air pollution.</li> <li>Route taken by transportation trucks should avoid densely populated areas where possible. Speed of vehicles should be reduced when passing through densely populated areas to avoid dust generation.</li> <li>Construction vehicles must be cleaned before existing the construction site.</li> <li>Construction vehicles will be required to comply with the latest emission standards.</li> <li>Construction vehicles must use diesel containing less than 10ppmw sulfur as required by law.</li> <li>Land excavators should follow class 4 emission standards as per diesel trucks.</li> <li>Oil products used by construction machinery will be subject to stringent requirements which meet regulatory standards.</li> <li>Regular maintenance of construction vehicles and machinery will be conducted.</li> </ul> <p><b>For offshore construction sites/ vessels/ machinery</b></p> <ul style="list-style-type: none"> <li>All vessels shall use the least sulfur-containing oil available in Taiwan.</li> <li>Exhaust air emission of vessel-carrying personnel should install smoke filters or activated carbon filters or other state-of-the-art commercially available technologies.</li> </ul>
Airborne noise and vibration	<ul style="list-style-type: none"> <li>Noise control standards need to be included within construction specifications of engineering contracts.</li> <li>The Project shall follow Noise Control Standards and its pertinent regulations.</li> <li>Use of construction equipment will be in accordance with noise control standards.</li> <li>Low-noise machinery will be utilised for construction works.</li> <li>During excavation works, trucks will be parked near excavators to minimise movement of excavators (which generate relatively more noise than trucks).</li> <li>Regular maintenance of construction vehicles and machinery will be conducted.</li> </ul>
Underwater noise	<ul style="list-style-type: none"> <li>Only one turbine piling will be conducted at each time.</li> </ul> <p>Also refer to mitigation measures proposed under "Biodiversity – Cetaceans".</p>
Surface water quality	<ul style="list-style-type: none"> <li>Sedimentation and grit equipment will be installed at the substation site to recycle wastewater or treat effluents to levels permissible for discharge. Specifications of the wastewater treatment facility will be decided at the design stage based on actual site needs.</li> <li>Construction materials will be stored in a designated covered area to reduce contact with rain.</li> <li>Portable toilets would be rented, or water treatment would be set up for construction personnel to use. Qualified cleaning staff will be commissioned to maintain the cleanliness and dispose of the wastewater produced.</li> <li>The approved pre-construction runoff wastewater pollution reduction plan will be implemented.</li> </ul>
Seawater quality	<ul style="list-style-type: none"> <li>The offshore construction zone will be clearly delineated.</li> <li>Warning devices will be set up around the offshore construction zone along with deployment of boats around the construction site to prevent non-Project vessels from entering.</li> <li>Centralised disposal best management practices shall be adopted. Ship wastewater and sewage will be retained on board or disposed onshore except where specified to be permissible for discharge into the sea.</li> <li>Wastewater generated by the crew on board vessels will be collected in wastewater tanks on the vessels and disposed onshore.</li> <li>The Project shall follow the Marine Pollution Prevention Law. In case of sea accidents, the captain and vessel personnel should take measures to prevent, remove or mitigate pollution, and instantly notify local navigation authorities, harbour management authorities or local competent authorities.</li> <li>Regular maintenance of vessels and machinery will be conducted.</li> </ul>
Solid waste	<ul style="list-style-type: none"> <li>Excavated soil will be backfilled where possible, while the remaining soil will be dealt with according to Changhua Coastal Industrial Zone regulations.</li> </ul>



Aspect	Mitigation measure
	<ul style="list-style-type: none"> <li>• To avoid overloading the amount of excavated earth and construction waste in transit, the waste will be covered to minimise impacts to the surrounding environment during transit.</li> <li>• Domestic waste produced by the construction workers will be collected and classified for recycling, and then removed by the local garbage and recycling trucks.</li> <li>• Construction waste should be properly collected and disposed according to general waste disposal regulations.</li> <li>• Waste such as waste parts, waste components, waste tires, waste batteries and waste solvents which are replaced by maintenance work shall be properly collected and disposed according to general waste disposal regulations to avoid arbitrary discard and environmental pollution in the construction area. For some recyclable wastes, they shall be recycled.</li> </ul>
Biodiversity – Terrestrial plants	<ul style="list-style-type: none"> <li>• Construction area will be clearly planned to prevent extensive vegetation removal.</li> <li>• Dust suppression measures will be implemented to reduce the impact of dust on plant growth.</li> <li>• Construction sites will be fenced off to contain pollution from construction activities.</li> <li>• Washing facilities will be installed at construction site entrances to allow construction vehicles to wash their vehicles before entering the site to prevent introduction of alien seeds or plants.</li> </ul>
Biodiversity – Terrestrial animals	<ul style="list-style-type: none"> <li>• Low-noise machinery will be used to minimise impact of noise to animals.</li> <li>• Contractors will be instructed to educate construction workers on treating animals. Workers will be prohibited from capturing, harassing or abusing wild animals.</li> <li>• Progressive construction methods will be adopted to reduce the impact on local wildlife and provide sufficient time and space for terrestrial animals to move away from the construction site.</li> <li>• Construction waste and wastewater will be managed appropriately to avoid polluting the terrestrial habitats.</li> </ul>
Biodiversity – Cetaceans	<p data-bbox="373 969 758 992"><b>Construction method and procedures</b></p> <ul style="list-style-type: none"> <li>• Jacket type foundation will be used for the WTG.</li> <li>• Acoustic deterrent devices (ADDs) will not be used.</li> <li>• State-of-the-art commercially available noise mitigation methods will be adopted to ensure that 160dB SEL at 750m from the piling location is maintained. Specific noise mitigation measures (eg bubble curtain) will be finalised before installation works.</li> <li>• Progressive pile driving (from low strength to high strength) will be employed.</li> <li>• Only one turbine piling will be conducted at each time.</li> <li>• Stop work procedures would be in place if cetacean activity is detected within the warning area (750m from piling location). Piling can only commence 30 minutes after the cetaceans have left the warning area.</li> <li>• If underwater acoustic devices record an exceedance in the noise level, countermeasures will be adopted immediately to lower the sound (eg lowering piling speed, decreasing intensity of pile energy and adjusting noise mitigation equipment).</li> <li>• No new piling activity would be started between 1 hour before sunset and sunrise.</li> <li>• Vessel speed will be kept below six knots when travelling within 1500m radius of the proposed major wildlife habitat of the Taiwanese Humpback Dolphin. Vessels will also avoid entering known Taiwanese humpback dolphins hotspot during their time of peak activity, and other sensitive areas.</li> </ul> <p data-bbox="373 1489 858 1512"><b>Establishment of warning and monitoring areas</b></p> <ul style="list-style-type: none"> <li>• A warning area and monitoring area of 750m and 1500m respectively from the piling site would be established.</li> <li>• Before starting piling works, various methods will be used to ensure that there is no cetacean activity for 30 minutes before piling starts, namely the following: <ul style="list-style-type: none"> <li>– Four underwater acoustic devices will be deployed 750m away from the piling location.</li> <li>– Three trained and certified marine mammal observers (MMO), of which at least one is a member of a local ecology group, will conduct visual searches in the warning and monitoring areas.</li> </ul> </li> <li>• During piling, underwater acoustic devices and MMOs will monitor the warning and monitoring areas for cetacean activities.</li> <li>• All pile driving activities (along with date and time of recording) will be recorded and stored for at least five years.</li> <li>• The Project Company will invite international cetacean experts to establish a professional and credible third-party cetacean monitoring team.</li> </ul>

Aspect	Mitigation measure
Biodiversity – Marine ecology	<ul style="list-style-type: none"> <li>• If the construction area is close to oyster shelf areas, anti-turbidity curtains will be deployed.</li> <li>• The intertidal area will not conduct excavation method and will use horizontal cable laying method.</li> <li>• Intertidal construction works will avoid the migratory period of November to March.</li> <li>• Protective seabed work stones designed to protect the wind turbine foundation may serve as an artificial reef.</li> </ul>
Public infrastructure	<ul style="list-style-type: none"> <li>• Appropriate warning signages/ traffic signs/ safety notices will be installed around the work area and at important road sections/ junctions.</li> <li>• Traffic control personnel will be assigned to maintain traffic flow.</li> <li>• The Project Company will coordinate with local traffic and road authorities in ensure local traffic flow is controlled.</li> <li>• Construction vehicles or personal vehicles of construction personnel will not be parked at Xianbei 4<sup>th</sup> Road and the corner of Xiangong Road.</li> </ul>
Cultural impact	<p><b>For land-based cultural resources</b></p> <ul style="list-style-type: none"> <li>• Archaeologists will be commissioned to monitor the excavation works for the onshore substation and land cables.</li> <li>• Should any cultural heritage relics be discovered during construction, they shall be handled in accordance to articles 33, 57, 77 and 88 of the Cultural Heritage Preservation Act (ie the discovery shall be reported to the competent authority and construction work shall be suspended until the conclusion of the review procedure).</li> </ul> <p><b>For underwater cultural resources</b></p> <ul style="list-style-type: none"> <li>• In accordance with article 13 of the Underwater Cultural Assets Preservation Act, if suspected underwater cultural assets are found during construction, activities would have to be stopped immediately (without compromising safety) and the competent authority would have to be notified immediately for further action.</li> <li>• The Project Company would have to adjust the WTG location if the suspected underwater cultural assets cannot be affirmatively verified.</li> </ul>
Visual impact	<ul style="list-style-type: none"> <li>• Machinery and materials will be placed orderly within the construction site.</li> </ul>
Vessel collision	<ul style="list-style-type: none"> <li>• A navigation safety plan will be formulated.</li> <li>• Vessels will only navigate on approved navigation channels.</li> <li>• Guard boats will be deployed during construction.</li> <li>• Appropriate offshore warning devices shall be put up to warn other ships not to enter the Project area.</li> <li>• Vessels will be equipped with night lights and light number following the Regulations for Preventing Collisions at Sea.</li> <li>• The Project will implement a Marine and Helicopter Coordination Centre (MHCC) to control and manage vessels inside the wind farm. The MHCC will respond to situation and command relevant vessels, and contact the Coast Guard Administration if necessary.</li> <li>• In case of sea accidents, local competent authorities will be notified immediately. Measures will be taken to prevent, remove or mitigate any accidental pollution.</li> <li>• The Project will follow the Disaster Prevention and Protection Act.</li> <li>• Vessels should conduct regular maintenance. All work vessels will be dispatched by professional teams and undergo sound vessel safety inspection.</li> </ul>

**Table 5.3: Summary of operation phase mitigation measures**

Aspect	Mitigation measure
Air quality	<p><b>For onshore sites</b></p> <ul style="list-style-type: none"> <li>• Operational personnel will be encouraged to take public transport and replace two-stroke locomotives. The Project operation and maintenance (O&amp;M) facility will eventually ban the use of replace two-stroke locomotives (in line with local regulations).</li> <li>• The Project O&amp;M facility will procure electric vehicles under its ownership and provide electric charging stations within the carpark compound.</li> </ul> <p><b>For offshore sites</b></p> <ul style="list-style-type: none"> <li>• All vessels shall use the least sulfur-containing oil available in Taiwan.</li> </ul>

Aspect	Mitigation measure
Airborne noise and vibration	<ul style="list-style-type: none"> <li>Project operations will comply with noise regulation standards.</li> </ul>
Solid waste	<ul style="list-style-type: none"> <li>Domestic waste will be collected and disposed appropriately.</li> </ul>
Biodiversity – Terrestrial ecology	<ul style="list-style-type: none"> <li>Maintenance works at the onshore substation and land cables will avoid having to cut through surrounding vegetation to prevent disturbance to terrestrial habitats and animals.</li> <li>Habitat restoration (ie landscaping) will be carried out in area surrounding the onshore facilities.</li> </ul>
Biodiversity – Seabirds	<ul style="list-style-type: none"> <li>The Project will install two video recording devices for offshore monitoring of bird activity (which is intended to supplement actual surveys to be conducted).</li> <li>The Project will set up a joint bird monitoring system in conjunction with neighbouring wind farms (ie the other Greater Changhua windfarms, Hailong Wind farm and Haiding wind farm). The monitoring system will comprise of thermal imagery, microphone, and high-performance radar.</li> <li>If large flocks of protected species or large sized birds are found to be passing through the wind farm, the operator shall be committed to conduct feasible speed reduction measures. It should be noted that the need and practicality for this requirement are under discussion with the EPA through the Spring Bird Survey review conducted with all developers. It is expected that the operational monitoring will inform this requirement.</li> <li>The Project adjusted its layout to mitigate collision risk by providing bird corridors of 2km in alignment with the expected migratory path of key species.</li> </ul>
Fishery impacts	<ul style="list-style-type: none"> <li>The Project Company will address compensation matters for the Changhua Fishery Association fishing rights areas that are affected by the Project.</li> <li>The Project Company will continue to communicate with local fishermen.</li> </ul>
Public infrastructure	<ul style="list-style-type: none"> <li>Personal vehicles of operation personnel will not be parked at Xianbei 4<sup>th</sup> Road and the corner of Xiangong Road.</li> </ul>
Vessel collision	<ul style="list-style-type: none"> <li>Rapid notification procedures will be established with the coast guard, port authorities and disaster prevention units.</li> <li>Emergency procedures will be in place to ensure timely action is taken to respond to emergency situations.</li> <li>The Project will use the vessel Traffic Management System (VTMS) to control ship traffic within the wind farm. The VTMS system will integrate different systems including radar, vessel automatic identification system (AIS) and CCTV.</li> </ul>

## 5.2 Monitoring measures

Monitoring measures have been proposed to collect data and assess the extent of Project impacts and effectiveness of mitigation measures proposed. Table 5.4, Table 5.5 and Table 5.6 below summarise the pre-construction, construction and operation phase monitoring plans respectively.

**Table 5.4: Summary of pre-construction phase monitoring plan**

Aspect	Monitoring items	Monitoring location	Monitoring frequency
Seawater quality	Water temperature, pH, biological oxygen demand (BOD), salinity, dissolved oxygen (DO), ammonia nitrogen, nutrient levels, suspended solids (SS), chlorophyll A, <i>E.coli</i>	Twelve locations near the wind farm	Once every season for a year (ie four surveys/year)
Underwater noise	Low frequency sound level, analysis of spectrogram, 1Hz band and 1/3 octave band	Two locations at the boundary of the wind farm	Thirty days each season for a year (ie four surveys/year)
Biodiversity – Birds	Species, abundance, habitat and activities, flight paths, migration pattern	Near the wind farm as well as coastal area around the cable landing point	Monthly between March to November and once between December to February for two years (ie 10 surveys/year)
	Radar survey	Project wind farm	Once every season for two years (ie four surveys/year), at least

Aspect	Monitoring items	Monitoring location	Monitoring frequency
			five days during the surveys in summer, autumn and spring, and a day and night survey in winter.
	Tagging and satellite tracing	Changhua coastline	Once every season for a year (ie four surveys/year)
Biodiversity – Cetaceans	Cetacean activity	Project wind farm	Twenty vessel surveys within a year
Cultural impact	Borehole sampling for land-based cultural heritage resources	Project onshore substation and land cables	At least three sampling points, with borehole results to be assessed by archaeologists
	Borehole sampling for underwater cultural heritage resources	Project wind farm	At every WTG, with borehole results to be assessed by archaeologists

**Table 5.5: Summary of construction phase monitoring plan**

Aspect	Monitoring items	Monitoring location	Monitoring frequency
Air quality	Wind direction, wind speed, TSP, PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO, NO <sub>2</sub>	Two locations: <ul style="list-style-type: none"> <li>• Wuqi fishing port</li> <li>• Project substation</li> </ul>	Once every season (ie four surveys/year)
Airborne noise and vibration	Equivalent energy sound level (day time, evening time and night time) and vibration level (day time and night time)	Two locations <ul style="list-style-type: none"> <li>• A sensitive receptor near construction site</li> <li>• The entry/exit point of the construction site</li> </ul>	24-hours continuous monitoring once every season (ie four surveys/year)
Construction noise	Low frequency and all-frequency sound levels	Two locations <ul style="list-style-type: none"> <li>• At the boundary of the substation site</li> <li>• At the boundary of the cable construction site</li> </ul>	Once every month (ie 12 surveys/year)
Underwater noise	Low frequency sound level, analysis of spectrogram, 1Hz band and 1/3 octave band	Four locations at 750m from each WTG piling site	For every WTG during piling
		Two locations at the boundary of the wind farm	Thirty days each season for a year (ie four surveys/year)
Seawater quality	Water temperature, pH, BOD, salinity, DO, ammonia nitrogen, nutrient level, SS, chlorophyll A, <i>E. coli</i>	Twelve locations near the wind farm	Once every season for a year (ie four surveys/year)
Biodiversity – Terrestrial ecology	Terrestrial plants and animals	Onshore transmission system (ie substation, land cable)	Once every season (ie four surveys/year)
Biodiversity – Birds	Species, abundance, habitat and activities, flight paths, migration pattern	Near the wind farm as well as coastal area around the cable landing point	Monthly between March to November and once between December to February (ie 10 surveys/year)
Biodiversity – Marine ecology	Intertidal zone	50m on both sides of the land cable	Once every season (ie four surveys/year)
	Plankton, fish eggs, fish larvae and benthic organisms	Twelve locations near the wind farm	Once every season (ie four surveys/year)
	Fishery species	Three measurement lines within the wind farm	Once every season (ie four surveys/year)
	Fish aggregation at the WTG foundation	One WTG	Once before piling and once after piling
	Cetacean	Project wind farm	Twenty vessel surveys within a year

Aspect	Monitoring items	Monitoring location	Monitoring frequency
Cultural impact	Land-based cultural heritage resources	Excavation areas	Archaeologist to monitor all excavation activities

**Table 5.6: Summary of operation phase monitoring plan**

Aspect	Monitoring items	Monitoring location	Monitoring frequency
Underwater noise	Low frequency sound level, analysis of spectrogram, 1Hz band and 1/3 octave band	Two locations at the boundary of the wind farm	Thirty days each season for a year (ie four surveys/year)
Biodiversity – Birds	Species, abundance, habitat and activities, flight paths, migration pattern	Near the wind farm as well as coastal area around the cable landing point	Monthly between March to November and once between December to February (ie 10 surveys/year)
	Joint bird monitoring system in conjunction with neighbouring wind farms (ie the other Greater Changhua windfarms, Hailong Wind farm and Haiding wind farm)	Likely to be at one WTG within the Project windfarm	Continuous monitoring
	Video recording devices	Two WTGs within the Project windfarm	Continuous monitoring
Biodiversity – Marine ecology	Plankton, fish eggs, fish larvae and benthic organisms	Twelve locations near the wind farm	Once every season (ie four surveys/year)
	Fishery species	Three measurement lines within the wind farm	Once every season (ie four surveys/year)
	Fish aggregation at the WTG foundation	Two WTG	Once every season (ie four surveys/year)
	Cetacean	Project wind farm	Twenty vessel surveys within a year
Fishery impacts	Fishery data (eg fishery environment, facilities, production, population)	Changhua County data	Once every year

## 6 Project E&S management plans

The Project Company will develop the following E&S management plans and assessments to meet both local and international requirements (ie EP and IFC PS):

**Table 6.1: Summary of operation phase mitigation measures**

E&S management plans	Compliance framework	Objective
Project Health, Safety and Environmental (HSE) Management Plan; Construction/ operation phase HSE management plan	Local/international standards	Manage HSE performance of the Project
1st Line Emergency Response Plan; Emergency response plan (ERP)	Local/international standards	Ensure all relevant parties are prepared to respond to emergency situations associated with the Project to prevent and mitigate any harm to people and/or the environment
Runoff wastewater pollution reduction plan	Local/international standards	Primarily to meet local regulatory requirements regarding minimising runoff wastewater form the construction site
Navigation safety plan	Local/international standards	Ensure offshore safety and prevent vessel collisions
Environmental and social management system (ESMS)	International standards (ie EP Principle 4 and IFC PS1)	The ESMS is designed to identify, assess and manage risks and impacts in respect to the Project on an ongoing basis.
Stakeholder engagement plan (SEP)	International standards (ie EP Principle 5 and IFC PS1)	The SEP will be scaled to the Project risks and impacts, and be tailored to the characteristics and interests of the affected communities, so as to demonstrate effective ongoing stakeholder engagement.
Grievance mechanism	International standards (ie EP Principle 6 and IFC PS1)	The grievance mechanism is designed for use by affected communities and workers, as appropriate, to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance.
Livelihood restoration plan (LRP)	International standards (ie IFC PS5)	Where economic displacement has been identified, an LRP will be developed to compensate affected persons and/or communities and offer other assistance that meet the objectives of IFC PS5.
Cumulative impact assessment (CIA)	International standards (ie IFC PS1)	As part of the risk and impacts identification process, cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the Project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted, should be assessed.
Critical habitat assessment (CHA)	International standards (ie IFC PS6)	A CHA is intended to identify critical habitats in the Project area, which are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes.
Biodiversity action plan (BAP)	International standards (ie IFC PS6)	If a Project is able to meet the IFC PS6 requirements for developing in areas of critical habitat, a BAP will be designed to achieve net gains of those biodiversity values for which the critical habitat was designated.

## 7 Stakeholder engagement

### 7.1 Overview

Stakeholder engagement (including information disclosure, public consultation and surveys) have been conducted throughout the Project development as part of the local EIA process. A stakeholder engagement plan (SEP) will be developed, which would detail the Project's future stakeholder engagement planning and events.

### 7.2 Past stakeholder engagement activities

The Project has undertaken several disclosure and consultation activities as part of the initial stakeholder engagement to understand public opinion and compensation requirements for the Project, and are in line with the local EIA requirements. Table 7.1 summarises the stakeholder engagement activities that have been conducted to date.

**Table 7.1: Past stakeholder engagement activities**

Stakeholder engagement activity	Date
Online publication of Project information on the EPA website for 15 days	9 January 2016
A public seminar	24 October 2016
A public opinion survey of the Project, wherein 750 local community members, 209 fishermen and 50 opinion leaders were interviewed	19 November 2016 – 11 December 2016
Online publication of major EIA chapters on the EPA website for 20 days	24 January 2017
Eight meetings with the Changhua Fishery Association	17 July 2018 – 16 October 2018

Source: Project Company

### 7.3 Planned stakeholder engagement activities

Stakeholder engagement is an ongoing process throughout Project development. Given that direct impacts to the local community are anticipated in addition to the feedback received in previous consultations, a stakeholder engagement plan (SEP) will be developed. A grievance mechanism will also be developed to provide a means for local communities to log a formal grievance regarding Project-related concerns which would have to be addressed by the Project Company.

At present, the Project will conduct a socio-economic baseline survey to assess baseline income levels of the affected people, which will be utilised to monitor the progress of livelihood restoration (eg restoration of income levels). As part of the socio-economic baseline survey, consultations with key informants and focus group discussions as well as household surveys will be conducted to collect information related to all potentially affected groups. A Project-specific livelihood restoration plan (LRP) will be developed for the Project using the outcomes of the socio-economic baseline survey.

## 8 Further information and contact details

This NTS has provided an outline of the information presented in the Project's approved EIA (and subsequent EIA amendment report) that is in a relatively simple format for the general public.

The full EIA is available on the EPA's website<sup>7</sup> in accordance with disclosure requirements of Taiwan EIA legislations.

For further Project information, please contact:

Address: Ørsted Taiwan  
19F, No.1  
SongZhi Rd., Xinyi Dist.  
Taipei 110411  
Taiwan

Website: <https://orsted.tw>

Email: [infoapac@orsted.com](mailto:infoapac@orsted.com)

Phone: +886 2 2722 1617

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<sup>7</sup> The Project's full EIA (including the amendment report) is available online on the EPA's EIA inquiry system:  
<https://eiadoc.epa.gov.tw/EIAWEB/10.aspx?hcode=1060461A&srctype=0>



## Appendix

## A. Baseline surveys

### A.1 Environmental baseline

Details of the environmental baseline survey efforts are summarized in the following table:

Aspect	Baseline survey efforts
Air quality	<p>Baseline ambient air quality was obtained through:</p> <ul style="list-style-type: none"> <li>• 2014-2016 monitoring results from three EPA monitoring stations (ie Shalu, Xianxi and Erlin monitoring stations)</li> <li>• Three 24-hour air quality surveys (measuring SO<sub>2</sub>, NO<sub>x</sub>, NO<sub>2</sub>, NO, CO, O<sub>3</sub>, total suspended particles (TSP), PM<sub>10</sub>, PM<sub>2.5</sub> and lead) conducted by the Project Company between August 2016 to November 2016 at six onshore locations near the coastline</li> </ul>
Noise and vibration	<p><b>Airborne noise</b></p> <p>Two 24-hour noise and vibration surveys were conducted by the Project Company between August 2016 and October 2016 at nine locations along the land cable route, main transportation roads and Taichung Port (where assembly works will be carried out). An additional survey was conducted at the Lunweu Changhua Coastal Park Service Centre in July 2017.</p> <p>Further, two 24-hour low-frequency noise surveys were conducted by the Project Company between August 2016 and October 2016 at 10 locations around the Project affected areas.</p> <p><b>Underwater noise</b></p> <p>An underwater noise survey was conducted by the Project Company in August 2016 by deploying underwater acoustic recorders at four locations within and around the wind farm area for a minimum of 30 minutes before and after high and low tide in a day.</p>
Surface water quality	<p><b>Offshore windfarm and cable area</b></p> <p>Baseline water quality at the offshore area was obtained through:</p> <ul style="list-style-type: none"> <li>• 2014-2016 monitoring results from three EPA monitoring stations and other neighbouring projects</li> <li>• Three marine surveys conducted by the Project Company between October 2016 to January 2017 at 12 locations in the wind farm area and three locations along the common corridor</li> </ul> <p><b>Submarine cable area (intertidal)</b></p> <p>A water quality survey was conducted by the Project Company in July 2017 at seven locations along the intertidal cable area.</p>
Groundwater quality	<p>Baseline groundwater quality data was obtained through 2014-2016 monitoring results at an EPA monitoring station (at Xianxi Elementary School, located more than 4km east of Lunwei Zone of Changhua Coastal Industrial Park).</p>
Soil and sediment quality	<p><b>Onshore substation and cable area</b></p> <p>A soil sampling survey was carried out by the Project Company in November 2016 at seven locations in the substation area and three locations along the cable route.</p> <p><b>Offshore windfarm area</b></p> <p>Two marine sediment surveys were conducted by the Project Company between October 2016 and December 2016. Sediment samples were taken at 12 locations within the windfarm area.</p> <p><b>Submarine cable area</b></p> <p>One marine sediment survey was conducted by the Project Company in July 2017 where in sediment samples were taken at three locations within the Lunwei area common corridor.</p>
Electromagnetic field	<p>An electromagnetic field survey was conducted by the Project Company in November 2016 at 14 locations around the Project substation and land cable route.</p> <p>An additional survey was conducted in January 2017 at four locations.</p>
Biodiversity	<p><b>Terrestrial flora and fauna</b></p> <p>Three surveys were conducted by the Project Company in August 2016, November 2016 and July 2017.</p> <ul style="list-style-type: none"> <li>• Plant species were identified through plot sampling.</li> <li>• Mammals were identified through line transects, animal traps, and anabat system investigation.</li> </ul>

Aspect	Baseline survey efforts
	<ul style="list-style-type: none"> <li>• Terrestrial birds were identified through day time point count surveys and night live crossing live surveys.</li> <li>• Amphibians and reptiles were identified through visual detection, stone flipping and chance observations.</li> <li>• Butterflies and dragonflies were identified through net capturing and visual observations.</li> </ul>
	<p><b>Marine plankton and algae</b></p> <p>Five marine surveys were conducted in the Project wind farm area from 2016 to 2017. Water samples were collected at different water depths for identification of phytoplankton and zooplankton in the laboratory. Dredging samples were used to identify marine benthic organisms. Plot sampling was used for marine plants.</p>
	<p><b>Fish</b></p> <p>Five fish surveys (including bottom trawling and gill netting) were conducted at three sampling stations in the Project wind farm area from 2016 to 2017. Local fish markets were also visited to verify local catch species.</p>
	<p><b>Sea birds</b></p> <p>A total of eight monthly surveys were carried out in spring (March-May) and summer (June-August) in 2016 using transect lines in the windfarm area and coastal area. Radars were also for raptor and nocturnal surveys.</p>
	<p><b>Cetaceans</b></p> <p>Z-shaped crossing lines within the Project area were surveyed over 20 days between April 2016 and January 2017 for visual observations of cetaceans.</p>

Source: EIA, 2018

## A.2 Social baseline

Details of the social baseline survey efforts are summarised in the following table:

Aspect	Baseline survey
Land acquisition; Physical displacement; Indigenous people	Desktop assessment, correspondence with local authorities and/or engagement activities were conducted from 2016-2018 (and ongoing) to identify affected communities, assess the Project impacts to the affected communities and determine appropriate mitigation measures.
Cultural resources	<p><b>Land-based cultural resources</b></p> <p>Literature review and field surveys were conducted in 2016 along the landing points, substation site and cable route.</p> <p><b>Underwater cultural resources</b></p> <p>Literature review and various sonar detection surveys were conducted from 2016-2017 within and around the windfarm area.</p>
Visual impact and tourism	<p>Photomontages were prepared in 2016 and 2017 from three viewing points along the coast nearest to the WTG area to assess potential visual impact of the Project during construction and operation.</p> <p>Traffic impact assessment was carried out to predict traffic service levels around the Project area and determine if there would be potential impacts to tourists accessing tourism/recreational sites near the Project area.</p>

Source: EIA, 2018